REMARKS

Claims 1-40 are pending in the application. Claims 20-40 are withdrawn from consideration as being directed to non-elected inventions. In the Office Action of October 16, 2003, the Examiner made the following disposition:

A.) Objected to claims 1-19.

B.) Rejected claims 1-19 under 35 U.S.C. §112, first paragraph.

C.) Rejected claims 1-2, 4, 6 and 9 under 35 U.S.C. §102(b) as being anticipated by *Sugai*.

D.) Rejected claims 1, 3, 5-10, 12 and 14-19 under 35 U.S.C. §102(b) as being anticipated by *Kubokoya*.

E.) Rejected claims 2, 4, 11 and 13 under 35 U.S.C. §103(a) as being unpatentable over *Kubokoya* in view of *Toyoda*.

Applicants respectfully traverse the rejections and address the Examiner's disposition as follows:

A.) Objection to claims 1-19:

Claims 1 and 10 have been amended as per the Examiner's request to overcome the objection.

Claims 2-9 and 11-19 depend directly or indirectly from claim 1 or 10 and are therefore allowable for at least the same reasons that claims 1 and 10 are allowable.

Applicants respectfully submit the objection has been overcome and request that it be withdrawn.

B.) Rejection of ed claims 1-19 under 35 U.S.C. §112, first paragraph:

Claims 1 and 10 have been amended as per the Examiner's request to overcome the rejection.

Claims 2-9 and 11-19 depend directly or indirectly from claim 1 or 10 and are therefore allowable for at least the same reasons that claims 1 and 10 are allowable.

Applicants respectfully submit the objection has been overcome and request that it be withdrawn.

C.) Rejection of claims 1-2, 4, 6 and 9 under 35 U.S.C. §102(b) as being anticipated by *Sugai*:

Applicants respectfully disagree with the rejection.

Referring to Applicants' Figures 8 and 10 as an illustrative example, Applicants' independent claim 1, as amended, claims a semiconductor device in which a second conductive layer 7 is connected through a connection pillar 5 to a first conductive layer 3 embedded in a groove 2a formed in an insulation film 2. The connection pillar 5 is distinct from the second conductive layer 7. The connection pillar 5 is formed directly on the first conductive layer 3 and has a width self-aligned to a width of the first conductive layer 3 and exhibits characteristics of being grown from a surface of the first conductive layer 3 without use of a growth guide at the width of the first conductive layer.

As shown in Figure 8, for example, the connection pillar 5 is grown vertically from the surface of the first conductive layer 3 without the use of a growth guide (such as a mask or via hole) located at the sides of the connection pillar 5. When the connection pillar 5 is grown, it self-aligns to the width of the first conductive layer 3 without requiring a growth guide at its sides to assist with aligning to the width of the first conductive layer 3.

As discussed in Applicants' specification, since Applicants' claimed connection pillar 5 is grown without the use of a growth guide, the claimed connection pillar 5 exhibits characteristics of improved coupling to the first conductive layer 3 and improved mechanical strength, compared to the characteristics exhibited by typical connection pillars that are formed using masks or via holes. (*See, e.g.*, Page 8, line 20 - page 9, line 5).

This is clearly unlike *Sugai*, which fails to disclose or even suggest: a connection pillar formed directly on a first conductive layer; a connection pillar that has a width self-aligned to a width of a first conductive layer; or a connection pillar that exhibits characteristics of being grown from a surface of a first conductive layer without use of a growth guide at the width of the first conductive layer. Referring to *Sugai* Figures 2A and 2B, *Sugai* discloses a first conductive layer 3 made of Al. A TiN layer 5 is formed on the first conductive layer 3. A mask 4 having a via hole is formed on the TiN layer 5. And a connection pillar 6 is formed in the via hole of the mask 4.

Thus, unlike Applicants' claim 1, *Sugai's* connection pillar 6 is not formed directly on *Sugai's* first conductive layer 3. Instead *Sugai's* connection pillar 6 is formed directly on *Sugai's* TiN layer 5. For at least this reason, *Sugai* fails to disclose Applicants' claim 1.

Further, *Sugai's* connection pillar 6 does not have a width that is self-aligned (or even

aligned) to a width of *Sugai's* first conductive layer 3. As clearly shown in *Sugai's* Figures, *Sugai's* connection pillar 6 has a width much narrower than *Sugai's* first conductive layer 3. And *Sugai* merely shows the connection pillar 6 from a single view point, so *Sugai* does not teach that the sidewalls of its connection pillar 6 may be aligned to the first conductive layer 3 when viewed from a different direction. For at least this additional reason, *Sugai* fails to disclose or even suggest Applicants' claim 1.

Yet further, *Sugai* fails to disclose or even suggest a connection pillar that exhibits characteristics of being grown from a surface of a first conductive layer without use of a growth guide at the width of the first conductive layer. Instead, similar to the conventional devices described in Applicants' Background of the Invention, *Sugai's* connection pillar 6 is clearly formed within the via hole of *Sugai's* mask 4. Thus, like other conventional devices, *Sugai's* device does not exhibit the characteristics of a connection pillar that is grown without use of a growth guide. Namely, unlike Applicants' claimed connection pillar, *Sugai's* connection pillar does exhibit improved coupling to the first conductive layer and improved mechanical strength.

Therefore, *Sugai* fails to disclose or even suggest claim 1.

Claims 2, 4, 6 and 9 depend directly or indirectly from claim 1 and are therefore allowable for at least the same reasons that claim 1 is allowable.

Applicants respectfully submit the rejection has been overcome and request that it be withdrawn.

D.) Rejection of claims 1, 3, 5-10, 12 and 14-19 under 35 U.S.C. §102(b) as being anticipated by *Kubokoya*:

Applicants respectfully disagree with the rejection.

Similar to claim 1, Applicants' claim 10, as amended, claims a semiconductor device in which a second conductive layer is connected through a connection pillar to a first conductive layer embedded in a groove formed in an insulation film. The connection pillar is distinct from the second conductive layer. The connection pillar is formed directly on the first conductive layer and has a width self-aligned to a width of the first conductive layer and exhibits characteristics of being grown from a surface of the first conductive layer without use of a growth guide at the width of the first conductive layer.

This is clearly unlike *Kubokoya*, which fails to disclose or even suggest: a distinct connection pillar formed directly on a first conductive layer; a connection pillar that has a

width self-aligned to a width of a first conductive layer; or a connection pillar that exhibits characteristics of being grown from a surface of a first conductive layer without use of a growth guide at the width of the first conductive layer. Referring to *Kubokoya* Figure 1, *Kubokoya* discloses a first conductive layer 103. A second conductive layer 105 is formed such that a portion of the second conductive layer 105 dips into a recess (similar to a wide via hole) and contacts the first conductive layer 103.

Thus, unlike Applicants' claim 1, *Kubokoya* does not even teach a connection pillar that is distinct from its second conductive layer. *Kubokoya* teaches no connection pillar. *Kubokoya* merely teaches that its second conductive layer 105 dips down to contact its first conductive layer 103, with no connection pillar therebetween. Accordingly, *Kubokoya* fails to disclose or even suggest Applicants' claims 1 and 10.

Further, as *Kubokoya* does not disclose a distinct connection pillar, *Kubokoya* could not disclose a connection pillar having a width that is self-aligned (or even aligned) to a width of *Kubokoya's* first conductive layer 103. Even if one were to interpret the portion of *Kubokoya's* second conductive layer 105 that dips to contact its first conductive layer 103, that portion that dips does not have a width that aligns with a width of *Kubokoya's* first conductive layer 103. For at least this additional reason, *Kubokoya* fails to disclose or even suggest Applicants' claims 1 and 10.

Yet further, *Kubokoya* fails to disclose or even suggest a connection pillar that exhibits characteristics of being grown from a surface of a first conductive layer without use of a growth guide at the width of the first conductive layer. As discussed above, *Kubokoya* fails to even disclose a distinct connection pillar. Further, the portion of *Kubokoya's* second conductive layer 105, which dips into a wide via hole to contact the first conductive layer 103, is clearly formed using the sides of the wide via hole. Thus, like other conventional devices, *Kubokoya's* device could not exhibit the characteristics of a connection pillar that is grown without use of a growth guide.

Therefore, *Kubokoya* fails to disclose or even suggest claims 1 and 10.

Claims 3, 5-9, 12 and 14-19 depend directly or indirectly from claims 1 or 10 and are therefore allowable for at least the same reasons that claims 1 and 10 are allowable.

Applicants respectfully submit the rejection has been overcome and request that it be withdrawn.

E.) Rejection of claims 2, 4, 11 and 13 under 35 U.S.C. §103(a) as being unpatentable over *Kubokoya* in view of *Toyoda*:

Applicants respectfully disagree with the rejection.

Claims 1 and 10 are allowable over *Kubokoya* as discussed above. *Toyoda* still fails to disclose or suggest a distinct connection pillar formed directly on a first conductive layer; a connection pillar that has a width self-aligned to a width of a first conductive layer; or a connection pillar that exhibits characteristics of being grown from a surface of a first conductive layer without use of a growth guide at the width of the first conductive layer. Therefore, *Kubokoya* in view of *Toyoda* still fails to disclose or suggest claims 1 and 10.

Claims 2, 4, 11 and 13 depend directly or indirectly from claims 1 and 10 and are therefore allowable for at least the same reasons that claims 1 and 10 are allowable.

Applicants respectfully submit the rejection has been overcome and request that it be withdrawn.

CONCLUSION

In view of the foregoing, it is submitted that claims 1-19 are patentable. It is therefore submitted that the application is in condition for allowance. Notice to that effect is respectfully requested.

Respectfully submitted,

Christopher P. Rauch (Reg. No. 45,034)
Christopher P. Rauch
SONNENSCHEIN, NATH & ROSENTHAL LLP
P.O. Box #061080
Wacker Drive Station - Sears Tower
Chicago, IL 60606-1080
Telephone 312/876-2606
Customer #26263
Attorneys for Applicant(s)